

Prediction and Control of Selective Laser Melting Product Microstructure, Phase I

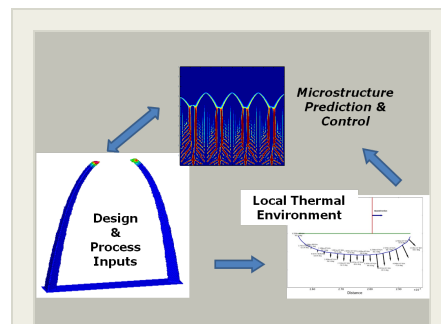
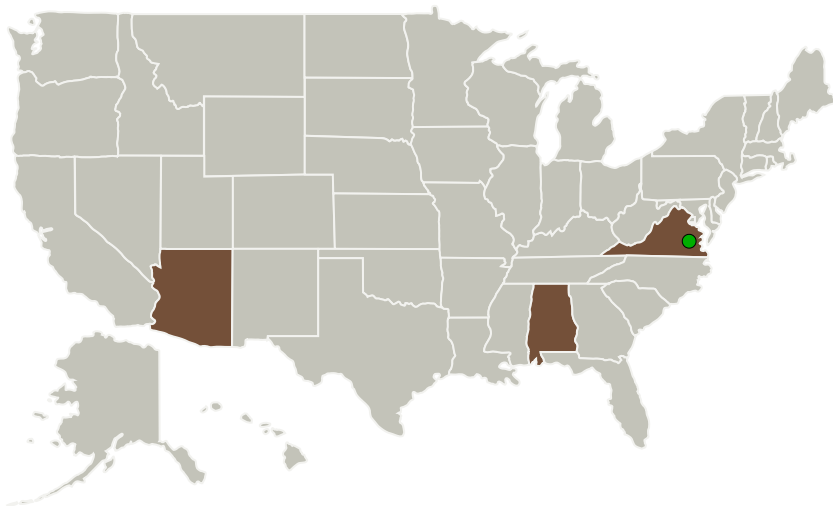
Completed Technology Project (2017 - 2018)



Project Introduction

Despite the rapid commercialization of additive manufacturing technology such as selective laser melting, SLM, there are gaps in models for material microstructure and property prediction that slow qualification and certification. Improvements in coupling microstructure prediction models to local process conditions, validation, and control of material microstructure are required to mature the state of the art. To address these needs, CFDRRC in partnership with Arizona State University will develop and apply modeling and simulation tools for prediction and control of microstructure in SLM fabricated parts. The Phase I effort will establish critical software elements, modeling methodology, and experimental data analysis required for Phase II. We will demonstrate the feasibility of high-fidelity models that are capable of predicting the formation of key metallurgical microstructures observed in SLM additive manufacturing processes as a function of the local thermal environment at different locations within the as-built component, reduced models for mapping process conditions to additional microstructure features impacting material quality, and potentially controlling material quality throughout a sample as-built part. The Phase II program will focus on the development of efficient, validated high-fidelity simulation codes and reduced models providing the means to reduce variability in as-built material microstructure and properties, and culminate with the delivery to these tools to NASA researchers and other stakeholders.

Primary U.S. Work Locations and Key Partners



Prediction and Control of Selective Laser Melting Product Microstructure, Phase I Briefing Chart Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

Prediction and Control of Selective Laser Melting Product Microstructure, Phase I

Completed Technology Project (2017 - 2018)



Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
Arizona State University-Tempe(ASU)	Supporting Organization	Academia Alaska Native and Native Hawaiian Serving Institutions (ANNH)	Tempe, Arizona
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Alabama	Arizona
Virginia	

Project Transitions

▶ **June 2017:** Project Start

✓ **June 2018:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140845>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

CFD Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

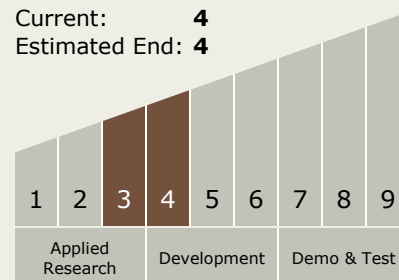
Carlos Torrez

Principal Investigator:

James V Cole

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**

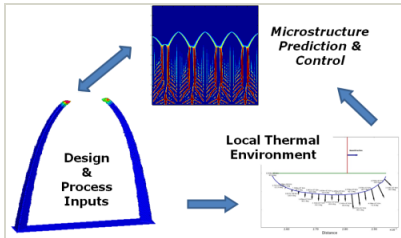


Prediction and Control of Selective Laser Melting Product Microstructure, Phase I

Completed Technology Project (2017 - 2018)



Images



Briefing Chart Image

Prediction and Control of Selective Laser Melting Product

Microstructure, Phase I Briefing Chart Image

(<https://techport.nasa.gov/image/132426>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System